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Cankered Stem.

Bacterial Canker of Cowpeas

By D. A. PRESTON
Assistant Plant Pathologist

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W. L. BLIZZARD, *Director* LOUIS E. HAWKINS, *Vice Director*

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Bacterial Canker of Cowpeas

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Bacterial canker is one of the most destructive diseases attacking cowpeas in Oklahoma. It has been reported from 37 counties (Figure 1), and probably occurs in others. The disease is also known to occur in 9 other states,** and probably is found on both edible and field varieties wherever cowpeas are grown in the southern states.†

In Oklahoma, at least, the disease has become severe enough to threaten the very existence of some of the cowpea varieties otherwise best adapted to the State. Chinese Red, widely grown in Oklahoma because it is well suited for combine harvesting, is especially susceptible.

The Oklahoma Station in 1944 started looking toward control of bacterial canker of cowpeas. This bulletin reports results of that research. The work showed that:

1. The disease was carried within the seed rather than on the outside of the seed coat, and none of the seed treatments tested gave effective control.

2. Certain varieties of cowpeas were found to be resistant to the disease; therefore the most promising method of control of cowpea canker at present is the use of these resistant varieties. They include Arlington, Blue Goose, Brabham, Brown Crowder, Holstein, New Era, and Victor. Of these, Brabham, Arlington, New Era and Victor are recommended because in Station variety tests they have made the highest yields of any of the resistant varieties.

3. Infected plant material after being plowed under may carry live bacteria for at least two years. Thus cowpeas would have to be omitted from a rotation for at least two years.

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* This bulletin is summarized from a thesis submitted to the Graduate Faculty of the University of Minnesota in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

** Alabama, Arkansas, Florida, Georgia, Illinois, Louisiana, Mississippi, South Carolina, and Texas.

† Brillhart (1) first mentioned bacterial canker of cowpeas. He reported several susceptible varieties at Perkins, Oklahoma, in 1931, and was able to isolate the pathogen from seed. Dunlap (3) mentioned that the disease was present on several varieties of cowpeas in Texas in 1942. Hoffmaster (4, 5) indicated the possibility of varieties being resistant to the disease on the basis of a field survey at Perkins in 1943. Burkholder (2) named the bacterium which causes the disease (*Xanthomonas vignicola* Burkh.), and showed by artificial inoculation that it could cause a blight of common kidney beans.

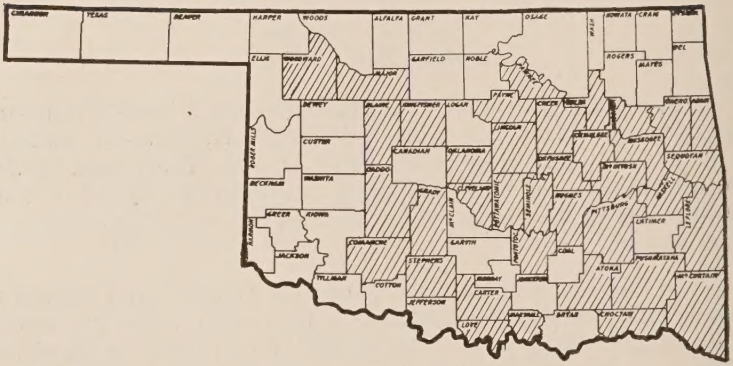

FIGURE 1.—The known distribution of bacterial canker in Oklahoma. It is probable that the disease also occurs in other counties but has not yet been reported.

4. Field observations indicate that certain insects may help spread the disease, but there is no experimental evidence to support these observations.

The information presented in this bulletin is based on greenhouse experiments made at Stillwater from 1945 to 1947 and field studies made in 1944 and 1945 in the Station's cowpea variety test plantings at Heavener, Lone Grove, Perkins, and Stillwater.* In the greenhouse work, the temperature was held between 81 and 86 degrees Fahrenheit, since both cowpea plants and the bacterial canker disease develop best within those temperatures.

Plants Affected**

The principal crop plant affected by bacterial canker is cowpea. Burkholder (2) showed that this disease would cause a blight of kidney bean by artificially introducing the bacteria into wounded stems, thereby demonstrating that the disease could be serious on this crop.

At Perkins, Oklahoma, the writer found typical canker and leaf blight symptoms on naturally infected catjang pea and asparagus-bean.

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* The cowpea variety tests are in charge of L. L. Ligon, Associate Agronomist, whose cooperation in providing facilities for the field work is gratefully acknowledged.

** Cowpea: *Vigna sinensis* (Torner) Hassk.; Kidney bean: *Phaseolus vulgaris* L.; Catjang pea: *Vigna cylindrica* (L.) Skeels; Asparagus bean: *Vigna sesquipedalis* Wight.

Symptoms

The bacterial canker disease symptoms may be found on any above ground part of the plant. A blight phase is noticeable on the cotyledons of young seedlings, and on the leaves of older plants. The pods may be affected, showing raised, reddish-brown spots, distortion, and poor development of seed. The stems of mature, infected plants develop the characteristic symptoms, swollen cankers and elongated cracks, from which the name of the disease is derived.

Blight Phase.—Water-soaked spots occur on the cotyledons and the first leaves of young seedlings. They begin to turn reddish-brown after a few days, eventually fading to a light yellow-brown as the infected parts dry out. The spots range from the size of a pinpoint to nearly half an inch in diameter. There is a progressive enlargement in the size of the spots until half or more of the surface of the older leaves may be affected. The blighted areas of older leaves are usually a light yellow-brown, with indefinite margins (Figure 2). Severely blighted leaves usually drop from the plant.

Pod Phase.—The spots on the pods are raised or swollen, reddish-brown, and may or may not be present on cankered plants. Often the pods are distorted, and there is a poor development of seed. Sometimes only one or two seeds in such a pod will reach mature size, while the rest are shriveled and will not germinate.

Canker Phase.—The stem cankers are usually found on older plants, but may be present on stems of younger plants as well. When cankers appear on the stems of seedlings and young plants, these plants seldom reach maturity. In such cases the plants become stunted, lose their leaves and often die before blooming. The stems of older diseased plants have reddish-brown swollen cankers or elongated cracks, which may appear anywhere from the ground line to the top of the plant. In very severe cases the stem may be cracked open for its entire length, with a gummy or flaky substance deposited on the cankers. It is very common for severely cankered stems to break over just above the crown (Figure 3).

How the Disease Is Spread

Buried plant parts which are infected with bacterial canker were shown in these experiments to be a source of infection. After being buried in the soil for two years it was still possible to infect healthy cowpea plants by using the bacteria, still present and living, in these old plant parts.

During these experiments it was found that the bacteria which cause this disease are carried in the seed. Such infected seed, when planted, may produce diseased plants.

Wind-driven rain and dew are important factors in spreading the disease in the field. During the course of this study the disease was transmitted from badly cankered to healthy plants by watering them with a hard spray directed through the diseased plants toward the healthy ones.

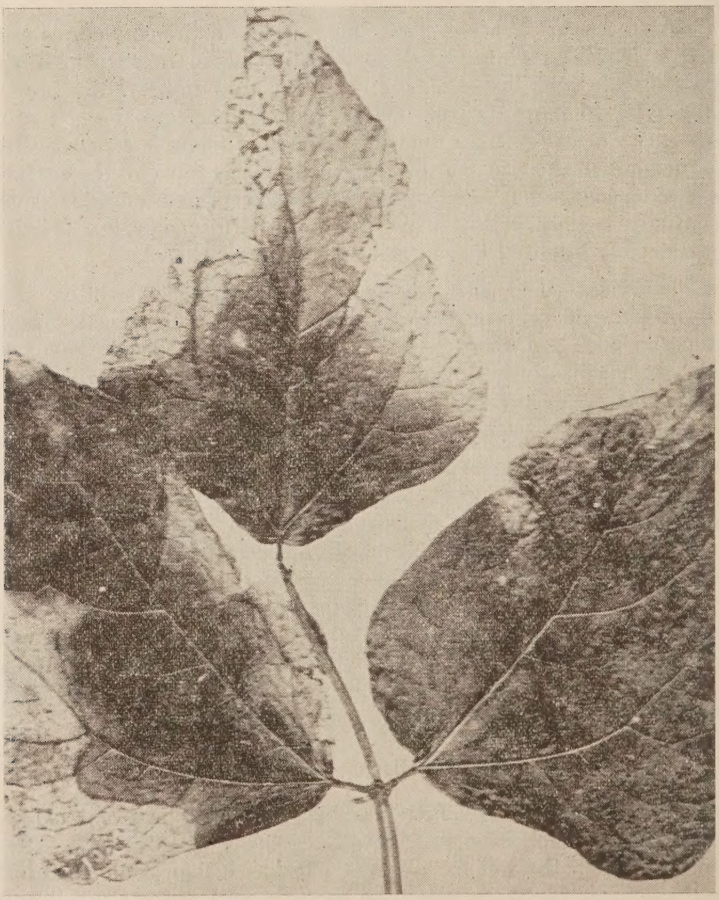

FIGURE 2.—The leaf blight phase of bacterial canker.

FIGURE 3.—Bacterial canker of cowpeas, showing how stems break over.

While the investigations were in progress, several kinds of insects were observed feeding on the leaves of cowpea plants. Although no experimental work has been done, there is a distinct possibility that some of these insects may be important in the spread of the disease in the field. Insects carrying the disease on their legs, mouthparts or bodies could spread the disease rapidly through a field of cowpeas. Insects which were particularly abundant and noticeable in the variety test plots were striped blister beetles, spotted cucumber beetles, and harlequin bugs.*

* Respectively: *Epicauta vittata* Fabricius; *Diabrotica duodecimpunctata* Olive; *Murgantia histrionica* (Hahn).

Seed Treatment Ineffective

Various chemicals were tested as seed treatments to see if bacterial canker could be controlled by this means. The chemicals used were:

1:1000 solution of mercuric chloride;
Arasan (tetra-methyl thiuramdisulfide);
Phygon (2, 3-dichloro-1, 4-napthoquinone);
Spergon (tetrachloro-p-benzoquinone);
Dow 9B (zinc 2, 4, 5-trichlorophenate);
Dubay 1452-F (ethyl mercury p-toluene sulfonanilide).
Untreated seed was planted as a check.

Bacterial canker developed on many of the plants in spite of these seed treatments.

Varietal Susceptibility

Cowpea varietal plantings at Heavener, Lone Grove, Perkins, and Stillwater, Oklahoma, were used to study the degree of susceptibility of different varieties of cowpeas to bacterial canker. This study was based on 20 varieties of cowpeas grown at Heavener, 30 at Lone Grove, 42 at Perkins, and 43 at Stillwater. The results for 1944 and 1945 are shown in Table I. The different varieties are arranged in three definite classes of susceptibility: most susceptible, intermediate, and least susceptible.

TABLE I.—Susceptibility of Cowpea Varieties to Bacterial Canker.

Variety	Av. Percentage of Infected Plants at:				No. of Repli-cations	Over-all Average
	Heavener	Lone Grove	Perkins	Stillwater		
Most susceptible						
Chinese Red	100.0	100.0	60.6	81.4	22	85.5
Whippoorwill Red	----*	----	97.0	61.3	7	79.1
Blackeye, Extra Early	95.0	100.0	43.1	40.5	22	70.9
Sumptuous	97.5	88.2	47.3	34.3	22	66.8
Blackeye, Early Wilt Resist. Ramshorn	77.2	85.5	31.3	48.6	20	60.6
Blackeye, Virginia	81.2	93.7	39.7	14.8	22	58.9
Blackeye, Large Virginia	52.2	100.0	45.6	6.1	22	51.0
Early Red	25.5	100.0	33.6	41.3	22	50.1
Whippoorwill	50.7	96.0	47.1	2.6	22	49.1
Early Red K-736	-----	65.0	29.9	48.8	16	47.9
Crowder, Cream	-----	68.0	34.8	37.3	16	46.7
Clay	46.2	82.0	41.1	6.8	22	44.0
Potomac	40.2	89.0	16.0	19.0	22	41.0
Blacks, Large	-----	-----	-----	39.1	6	39.1
Intermediate						
Blackeye 7711	-----	25.0	30.1	46.6	16	33.9
Rice	-----	-----	34.8	29.6	14	32.2
Purple Hull	-----	-----	17.5	45.8	14	31.6
Lady Edible	-----	71.0	20.2	0.0	16	30.4
Groit	37.0	51.7	29.8	1.4	22	30.0
Columbia	-----	-----	23.5	35.1	14	29.3
Blacks	53.0	24.5	35.1	3.3	22	29.0
Crowder, Speckled	11.2	27.2	24.1	50.0	22	28.1
Red Ripper K-711	-----	17.5	15.9	51.0	16	28.1
Crowder, Blackeye White	-----	-----	11.7	43.1	14	27.4
Crowder, Red Speckled	-----	-----	14.1	39.6	14	26.8
Blackeye, White Browneye	16.0	22.0	21.2	47.6	22	26.7
Dixie Queen	34.2	7.0	20.7	41.6	20	25.9
Blackeye No. 7	-----	-----	22.0	23.6	7	22.8
Blackeye, Early Ramshorn	-----	-----	43.5	0.3	14	21.9
Red Ripper	25.0	41.0	15.8	3.3	20	21.3
Blackeye, Great Wilt Resist. Ramshorn	-----	-----	35.4	6.1	14	20.7

* Indicates that variety was not included in the plot at this locality.

(Table continued on next page.)

TABLE I.—Susceptibility of Cowpea Varieties to Bacterial Canker. (Continued)

Variety	Av. Percentage of Infected Plants at:				No. of Replications	Over-all Average
	Heavener	Lone Grove	Perkins	Stillwater		
Least Susceptible						
Blue Goose	25.7	38.5	15.2	0.0	22	19.8
Buff	*---	-----	15.6	22.0	14	18.8
Iron	-----	-----	1.9	35.6	11	18.7
Victor K-798	-----	0.0	17.0	38.6	16	18.5
Holstein	-----	28.5	15.2	8.0	18	17.2
Iron K-329	-----	0.0	12.6	36.8	16	16.5
Brabham K-892	-----	0.0	9.8	33.1	16	14.3
Crowder, Brown	5.2	16.0	20.5	2.8	22	11.1
Arlington	-----	5.7	9.1	17.8	18	10.9
New Era	3.0	14.0	17.2	1.1	22	8.8
Brabham	3.5	4.2	11.1	6.6	22	6.3
Victor	-----	-----	4.5	1.1	14	2.8

* Indicates that variety was not included in the plot at this locality.

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